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Assessment of Biopesticide Potential of *Jatropha curcas*

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Abstract*—Jatropha curcas*** is well known for production of biofuel. However, this plant also has chemical consitituents like phorbol esters and terpenoids which impart pest resistant properties. Plant extract of *Jatropha* have been tested on different pest or insect to evaluate its biopesticide potential. This paper attempts to highlight significant role of *Jatropha* in control of pest infestation.

Keywords—*Jatropha, biopesticide*

I. INTRODUCTION

Jatrophacurcas (Linnaeus) is originally native of tropical America, but now is widely common in many parts of the tropics and sub-tropics in Africa/Asia. It belongs to the family of Euphorbiaceae and has been widely known as biofuel crop [1]. Another important advantage with this crop is that it is easy to establish, grows relatively quickly and is hardy and also drought tolerant. It can grow well even in marginal/poor soil. It is easy to establish, grows relatively quickly and lives, producing seeds for 50 years. Oil content in seeds of *Jatropha* is 37%. The oil derived from seeds can be used as fuel without being refined. This oil has potential to undergo combustion with clear smoke-free flame. It has been tested successfully as fuel for simple diesel engine. *Jatropha curcas* is becoming the future source of biodiesel for India. It is found to be growing in many parts of the country, and can grow with minimum inputs [2]. Among the various oil seeds, *Jatropha curcas* has been found more suitable for biodiesel production. It is possible to grow this plant under stress condition and the oil of these species have various characteristics which makes it suitable for biodiesel production. *Jatropha* oil has higher cetane no. (51) as compared to other oils which make it an ideal alternative fuel for engine [3].

There are many advantages associated with *Jatropha*. One advantage of *Jatropha* is that it can be grown in arid zones (20 cm rainfall) as well as in higher rainfall zones. This plant is a quick yielding species even in adverse land situations, such as degraded and barren lands under forest and non-forest use, dry and drought prone area and marginal lands with alkaline soils. It is also considered as good plant material for eco-restoration in all types of wasteland. *Jatropha* is not considered good forage material. Moreover this plant is highly pest and disease resistant. *Jatropha* is also important from ecological point of view as it removes carbon from the atmosphere, stores it in the woody tissues and assists in the build-up of soil carbon. The plant also holds application to prevent and/or control erosion, to reclaim land, to act as a live fence, especially to contain or exclude farm animals and to be planted as a commercial crop. It is not browsed by animals as its leaves and stems are distasteful to animals. However, after treatment, the seeds or seed cake could be used as an animal feed. All parts of the plant are of medicinal value. Bark of *Jatropha* contains tannin which attracts bees and thus the plant has a honey production potential. Wood and fruit of this plant can be used for numerous purposes including fuel production. Its fruit contain viscous oil that can be used for soap making, in the cosmetics industry and as a diesel/kerosene substitute or extender. Its use as bio-diesel is important because it can be considered as practical substitutes for fossil fuels to counter greenhouse gas accumulation. However, the full potential of *Jatropha* has not been fully realized due to several reasons. Firstly, the growing and management of *Jatropha* is poorly documented. Secondly, there are fewer efforts put forward towards marketing its products. Therefore, actual or potential growers are generally reluctant to invest time and money in a crop that only has promise rather than concrete rewards.

II. BIOPESTICIDE POTENTIAL OF *JATROPHA*

Jatropha curcas has significant properties to be considered as biopesticide. Its seed oil has also been used to reduce infestation of insect pests [*Aphids crassivora* Koch (Hemiptera: Aphididae), *Maruca testulalis* F. (Lepidoptera: Crambidae) and *Megalurothrips sjostedti* Trybom (Thysanoptera: Thripidae)] in cowpea [4]. In another study the acetonolic, ethanolic and water extracts of the root and seeds of *Jatropha curcas* exhibited satisfactory insecticidal bioactivity which can successfully substitute chlorpyrifos (synthetic insecticide) in the control of insect *Oecophylla longinoda* [5]. Insecticidal activities of *Jatropha curcas*plant parts have also been reported against mosquitoes, *Anopheles arabiensis* Patton (Diptera: Culicidae) [6], *Sitophilus zeamais* Motschulsky (Coleoptera: Curculionidae) [7], mites, *Rhipicephalus* (Boophilus) *annulatus* (Ixodida: Ixodidae) [8], cockroaches, *Periplaneta americana* Linnaeus (Blattodea: Blattidae) [9], Desert locusts, *Schistocerca gregaria* Forskal (Orthoptera: Acrididae) [10], *Busseola fusca* Fuller (Lepidoptera: Noctuidae) and *Sesamia calamistis* Hampson (Lepidoptera: Noctuidae) [11], *Helicoverpa zea* Boddie (Lepidoptera: Noctuidae) [12], termites; *Coptotermes* (Blattodea: Rhinotermitidae) and *Odontotermes obesus*Rambur (Blattodea: Termitidae) [13,14, 15]. Table 1 summarize effect of *Jatropha* extract on growth of different insects.

Table 1: Effect of *Jatropha* extract on growth and number of different insects

Insect	**Result**	**Authors**
Black moth	Decrease	[16]
Helicoverpa Armigera	Decrease	[16]
Bactrocera cucurbitae	Decrease	[17]
Oecophylla longinoda	Decrease	[5]
Callosobruchus Maculatus	Decrease	[18]
Sitophilus zeamais	Decrease	[7]
Aphids crassivora	Decrease	[4]
Maruca testulalis	Decrease	[4]
Megalurothrips sjostedti	Decrease	[4]
Periplanata Americana	Decrease	[9]
Schistocerca gregaria	Decrease	[10]
Rhipicephalus annulatus	Decrease	[8]

Anopheles arabiensis	Decrease	[6]
Odontotermes obesus	Decrease	[15]
Coptotermes vastator	Decrease	[13, 14]
Helicoverpa zea	Decrease	[12]
Culex quinquefasciatus	Decrease	[19]

Biopesticide property of seed oil of *Jatropha* can be attributed to its specific chemical constituent which can target pest during different stages of life cycle. Seed oil derived from *Jatropha* have been reported to effect oviposition deterrence and inhibited egg hatching in potato tuber moth, *Phthorimaea operculella* Zeller (Lepidoptera: Gelechiidae) [20]. It also inhibited growth of tobacco hornworm, *Manduca sexta* Linnaeus (Lepidoptera: Sphingidae) larvae [21]. Application of *Jatropha* seed oil had resulted in anti-ovipositional activity and longterm protective ability of treated cowpeas against the seed beetle *Callosobruchus maculatus* F. (Coleoptera: Chrysomelidae: Bruchinae) [22]. Moreover its application has reduced the number of tested insect pests (*Aphids crassivora*, *Maruca testulalis* and *Megalurothrips sjostedti*) in a field trial to control field pests of cowpea [4]. Recently, *Jatropha curcas* has been reported to increase mortality of black moth [16].

This high bioactivity of *Jatropha* oil can be attributed to the presence of phorbol esters in the kernels, stem, flowers, buds, roots, bark (outer brown and inner green) skins and wood [23]. *Jatropha* species also contain terpenoid compounds, among which are diterpenoid compounds with about 68 diterpenes [24]. Majority of these diterpenes are cytotoxic, antitumor and antimicrobial activities while the phorbol ester, lignans, cyclic peptides, terpenes and Jatropherol display insect deterrent and a broad range of biological activities [25]. Further phytochemical analysis of the root, stem and petiole of the plant showed the presence of alkaloids, saponins, tannins, terpenoids, steroids, glycosides, phenols and flavonoids [26] which are known to have bactericidal, fungicidal and antimicrobial properties [27, 28, 29]. The seed is known to possess a generous amount of curcin toxalbumin [30] which is known to inhibit protein synthesis in-vitro. The modification of amino acids (arginine, lysine, and tryptophan) in the active site results in loss of the inhibitor activity [31] which may be fatal to insects.

CONCLUSION

The present paper highlight that *Jatropha* resulted in reduction of growth of pest under different experimental conditions. Moreover, since this crop can survive in barren or arid areas, it hold significant value to be explored as future biopesticide.

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